ZooKeys 520: 87–108 (2015)
doi: 10.3897/zookeys.520.6142
http://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

A new case of an Holarctic element in the Colombian Andes: first record of *Cordyla* Meigen (Diptera, Mycetophilidae) from the Neotropical region

Olavi Kurina[1], Sarah Siqueira Oliveira[2]

1 *Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Kreutzwaldi st 5-D054, 51014 Tartu, ESTONIA* **2** *Universidade Federal de Goiás, Campus II. Instituto de Ciências Biológicas, Departamento de Ecologia, prédio ICB1. CP 131, CEP 74001-970, Goiânia – GO, BRAZIL*

Corresponding author: *Olavi Kurina* (olavi.kurina@emu.ee)

Academic editor: *Jukka Salmela* | Received 25 July 2015 | Accepted 24 August 2015 | Published 16 September 2015

http://zoobank.org/DBEFD0DC-B92B-4CCC-991B-E047BEB670B8

Citation: Kurina O, Oliveira SS (2015) A new case of an Holarctic element in the Colombian Andes: first record of *Cordyla* Meigen (Diptera, Mycetophilidae) from the Neotropical region. ZooKeys 520: 87–108. doi: 10.3897/zookeys.520.6142

Abstract

Three new species of Mycetophilidae – *Cordyla monticola* **sp. n.**, *Cordyla pseudopusilla* **sp. n.** and *Cordyla reducta* **sp. n.** – are described from the Colombian Andes, representing the first described species of *Cordyla* Meigen from the Neotropical region. Colour photos of their habitus, wing and terminalia are provided. The morphological affinities of male terminalia are discussed in a worldwide context. The distributional pattern of the genus clearly indicates a case of northern elements reaching the north-western region of the Neotropics that corresponds to a secondary extension of a Holarctic clade to the south.

Keywords

Diptera, Mycetophilidae, fungus gnats, *Cordyla*, Neotropical region, taxonomy, distribution

Introduction

Members of the monophyletic genus *Cordyla* Meigen, 1803 are well distinguished among fungus gnats (Diptera: Mycetophilidae) because of their considerably small size, strongly humpbacked habitus, reduced number of flagellar segments and swollen antepenultimate segment of palpus. The latter character is unique within fungus gnats worldwide, enabling immediate recognition while working with collections on the genus level.

Copyright *Olavi Kurina, Sarah S. Oliveira.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Further identification of the species is based on several body-characters with emphasis on the number of flagellomeres, and colour and length of the swollen palpal segment. However, as usual, the most important set of the species level morphological characters is that of the male terminalia. According to their structure, the genus has been divided into three subgeneric groups as defined by Kurina (2001). Tuomikoski (1966) transferred *Cordyla* to the tribe Exechiini within which it has a rather isolated position (Rindal et al. 2009, Ševčík and Kjærandsen 2012).

Thirty-nine species are described in the limits of the genus so far, viz. twenty-four from the Palaearctic region, ten from the Nearctic region, three from the Oriental region and two from the Australasian region (Kurina and Oliveira 2013 and references therein). From undescribed species, the genus has also been known in the Neotropical region (Oliveira et al. 2007, Vockeroth 2009, Kurina and Oliveira 2013).

Over recent years the junior author has accumulated *Cordyla* specimens collected in Colombian Andes. The aim of this paper is to describe, illustrate and discuss three new *Cordyla* species from that material representing the first named species in the Neotropical region.

Material and methods

All material was collected with Malaise traps from the Colombian Andes at an altitude greater than 1900 m a.s.l. from 2001 to 2003. The collecting was performed during "The Colombian Arthropod Project (CAP)" – a collaborative arrangement between the Humboldt Institute in Villa de Leyva, Colombia, the University of Kentucky, and the Natural History Museum of Los Angeles County (LACM) – funded by U. S. National Science Foundation (NSF DEB 9972024) and the Humboldt Institute (see also http://www.sharkeylab.org/biodiversity/static.php?app=colombia&page=index). The material herein studied was collected from three protected areas of Colombia (see also http://www.parquesnacionales.gov.co/ and Fig. 38) as follows: 1) the "Parque Nacional Natural Farralones de Cali" ("PNN Farralones de Cali" within the label data) located on the West Cordillera and characterized by a great variety of climates that are reflected in a variety of ecosystems, as cold regions with paramillos and its diverse vegetation, warm areas with plants with tabular roots and reaching considerable heights, and temperate areas with oaks and black oaks; 2) the "Santuario de Flora y Fauna Otún Quimbaya" ("SFF Otún Quimbaya" within the label data) characterized by evergreen sub-Andean jungle vegetation, in which the effect of the rainy and dry seasons is masked by the usual presence of mist formations and there is gradual replacement of low synchrony in the production of fruits and leaves, and is located on the West Cordillera, and 3) the "Santuario de Flora y Fauna Iguaque" ("SFF Iguaque" within the label data) locating on the East Cordillera, in a region of paramo and Andean forest ecosystems, including a representative sample of oak forest.

The examined material was initially stored in ethyl alcohol, within which most specimens – after study under a stereomicroscope Leica S8APO – are still preserved.

In case of several specimens, for more detailed study of male terminalia, they were detached and macerated in a solution of KOH, followed by neutralization in acetic acid and washing in distilled water. The remaining chitinous parts were thereafter inserted into glycerine for study including illustrations and preserved as glycerine preparations in polyethylene microvials (cf. Kurina 2003). A few specimens including their terminalia were slide mounted in Euparal following the method described by Hippa and Kurina (2012). The preservation method of each specimen is indicated in the material section. The measurements are given as the range of measured specimens followed by the mean value, while the measurements and setosity information from the holotype are given in square brackets. The ratios of the three apical palpal segments are given as 3^{rd}:4^{th}:5^{th}. All measurements are taken from specimens in alcohol. Morphological terminology follows generally that of Søli et al. (2000) and Amorim and Rindal (2007) while the interpretation by Kjærandsen (2006) and Oliveira and Amorim (2012) are used for terminalia and thorax, respectively.

The habitus photos have been made in an alcohol medium and combined by software LAS V.4.5.0. from multiple gradually focused images taken by a camera Leica DFC 450 attached to the stereomicroscope Leica M205C. The photos of terminalia were combined by the same software but the camera was attached to the compound microscope Leica DM 6000 B (see also Kurina et al. 2015). Adobe Photoshop CS5 was used for editing the figures and compiling the plates.

The distributional map was performed with the software DIVA-GIS 7.5.0 (http://www.diva-gis.org/) and edited with Adobe Photoshop. The shapefile maps from Colombia and South America were obtained from DIVA-GIS and Dreamstime (ID 10514087 © Michael Schmeling and Dreamstime.com) websites, respectively.

The following acronyms are used for depositories:

IAvH	Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia.
IZBE	Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences [former Institute of Zoology and Botany], Tartu, Estonia.
MZUSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil.

The species

***Cordyla monticola* sp. n.**
http://zoobank.org/7A0180A6-F306-4E8D-B566-89853152F6AA
Figs 1–9, 38

Type material. *Holotype.* ♂, COLOMBIA, Boyacá / SFF Iguaque El Níspero / 05°38'N 73°31'W 2730 m / Malaise 2 07-21.xii.2001 / P. Reina Leg. M. 2585 [IAvH]. *Paratype.* 1♂, same as holotype [MZUSP].

Description. Male (Fig. 1). Total length 4.1–4.6, 4.4 [4.6] mm (n=2).

Figures 1–2. *Cordyla monticola* sp. n. **1** male habitus **2** head with antennae and maxillary palpi, closer view. Scale bars: 1 mm (**1**) and 0.2 mm (**2**).

Head (Fig. 2) dark yellow, mouthparts pale. Two ocelli encircled by brown areas, close to compound eyes. All three visible palpal segments (Fig. 2) setose, swollen antepenultimate segment dark brown, succeeding segments pale. 4th segment slightly widening apically, 5th segment apically tapering. Swollen palpal segment 1.6 times as long as broad medially from lateral view, and 1.1–1.3, 1.2 [1.1] times as long as height of compound eye. Ratios of three apical palpomeres 1.0: 0.9: 0.9. Antenna yellow with 2+13 segments. Scape and pedicel with brown setae, flagellum with somewhat paler setosity. Scape elongate cup-shaped, 1.7–2.2, 2.0 [2.2] times as long as wide apically. Pedicel cup-shaped, 0.9 times as long as wide apically. Flagellomeres rectangular, about twice as wide as long. Apical flagellomere conical, about 1.6 times as long as wide basally. **Thorax** yellow, mesonotum medially, laterotergite and mediotergite somewhat darker. Hind margin of laterotergite narrowly brown. Anterior part of mesepimeron with a dark brown patch leaving anteroapical margin yellow. Haltere with pale knob, and basally pale and apically yellow stem. All setosity on thorax brown. Scutum entirely covered with decumbent setae, scutellum with setae including two pairs of marginal bristles, laterals shorter than internals. Antepronotum with setae including 6–8 [8] bristles, proepisternum with setae including 6–8 [8] bristles. Anepisternum with 2–4 [4] bristles at hind margin and with ca. 50 setae on its upper two thirds. Mesepimeron and katepisternum bare. Laterotergite with 5–6 [6] bristles and ca. 20 setae on upper half. Mediotergite bare. Metepisternum with 5–7 [7] bristles and ca. 10 setae. **Wing** with yellowish tinge, cell R1 somewhat darker. Length 3.1 [3.1] mm (n=2). Ratio of length to width 2.5–2.6, 2.6 [2.6]. All veins light brown. Radial veins seem darker

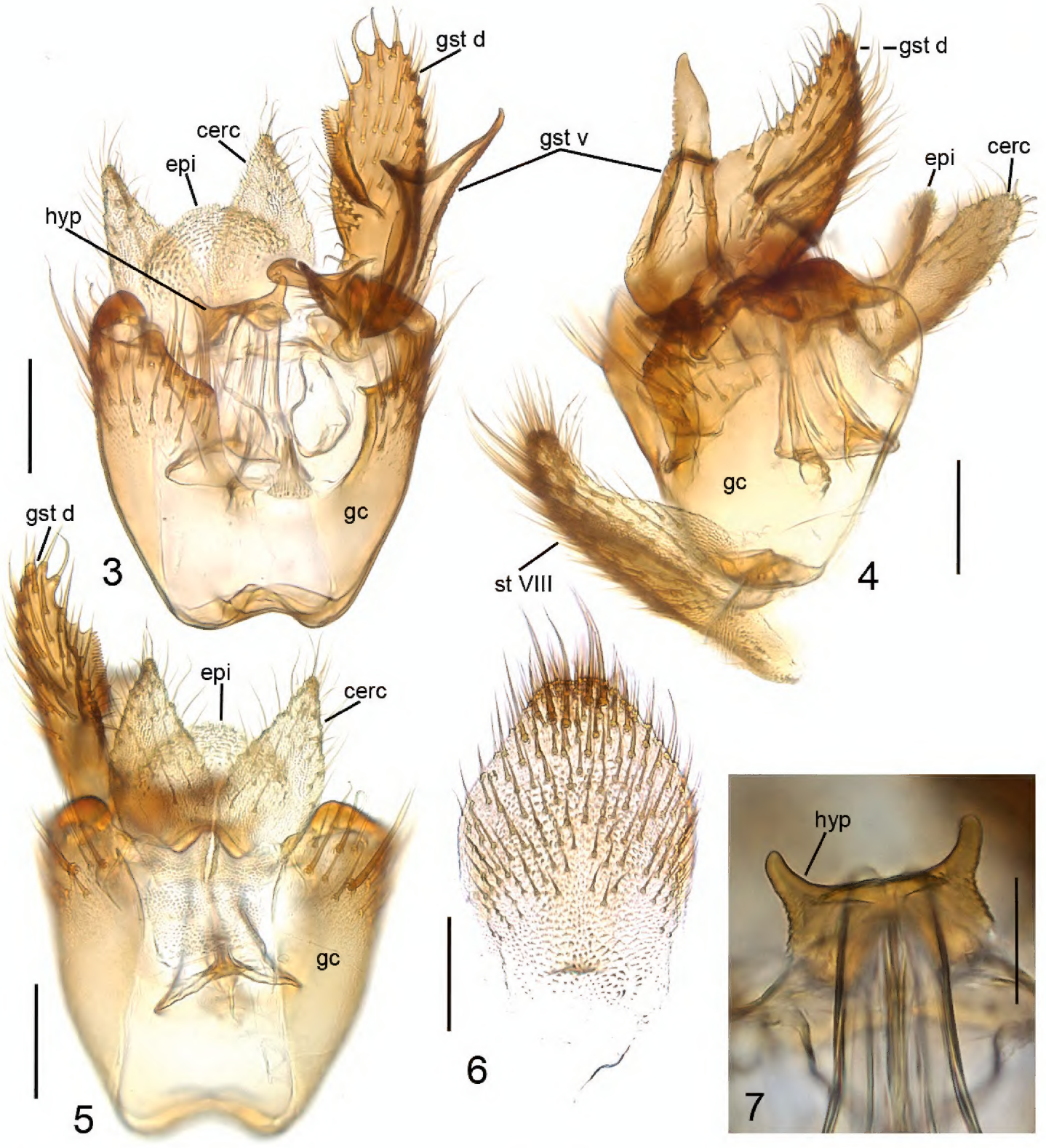
because of setae on both surfaces; other veins bare. Crossvein r-m apically disjunct. M1+2 3.5–3.7, 3.6 [3.7] times as long as r-m. M2 not reaching wing margin, broken 0.4–0.8, 0.6 [0.4] times of M1+2 length before it. Posterior fork begins clearly before anterior fork, at the middle of M1+2. **Legs** yellow, hind femora infuscated at apical fourth. Tarsi seem darker because of dense brown setae. Hind coxa with 4 [4] posterolateral bristles basally, with 0–2 [2] posterior bristles apically, and with ca. 30 weaker setae along posterolateral margin. Ratio of femur to tibia for fore-, mid- and hind legs: 1.5; 1.1; 1.0. Ratio tibia to first tarsomere for fore-, mid- and hind legs: 1.0; 1.2; 1.4. Fore-tibia with a spur about 0.5 of fore basitarsus; mid-tibia with anterior spur about 0.3–0.4, 0.4 [0.3] and with posterior spur about 0.6–0.7, 0.7 [0.6] of mid basitarsus; hind tibia with anterior spur about 0.5–0.6, 0.6 [0.5] and with posterior spur about 0.6–0.7, 0.7 [0.6] of hind basitarsus. **Abdomen** with first segment dorsally and laterally light brown and ventrally yellow. 2–4 segments dorsally brown with anterior and posterior margins yellowish, and laterally and ventrally yellowish; succeeding segments brownish. **Terminalia** (Figs 3–9) with gonocoxite basally yellow and apically brownish; gonostylus brownish; sternite 8 seems brownish because of dense setosity. Basal two thirds of sternite 8 cylindrical, apical third tapering, apex truncated. Basal third of sternite 8 membranous and bare, apical setae stronger than other setae. Gonocoxite slightly oblong, with broad ventral incision more than half of gonocoxite height. Ventral incision of gonocoxite with apically pointed basal projection about one third height of incision. Ventral medial margin of gonocoxite angular. Dorsal medial margin of gonocoxite simple. Cerci setose, clearly separated, basally wide, well tapering apically and protruding over gonocoxite. Basal half of gonocoxite bare, apical half with strong bristles. Dorsal branch of gonostylus rectangular, apically rounded, with a medially situated sclerotized comb of about half height of branch on its ventral surface. Apical setae somewhat stronger, deviating from other setosity of the branch. Dorsal branch of gonostylus with an indistinct basal tubercle on its ventral surface, close to base of medial branch. Ventral branch of gonostylus bare, subequal to dorsal branch, with serrated lateral margin and medially drawn out to a distinct lobe. The apical third of ventral branch is well tapering in ventral view. Medial branch of gonostylus divided at apical two thirds into two subequal lobes: ventral lobe rectangular, apically truncated, bearing 9-10 setae on its ventral part; dorsal lobe beak-shaped with two setae subapically on its ventral margin. Epiproct rounded with small setulae that arise in lines of 4 to 8 from small ridges. Hypoproct bowl-shaped with well-outlined lateral shoulders.

Female. Unknown.

Biology. Unknown.

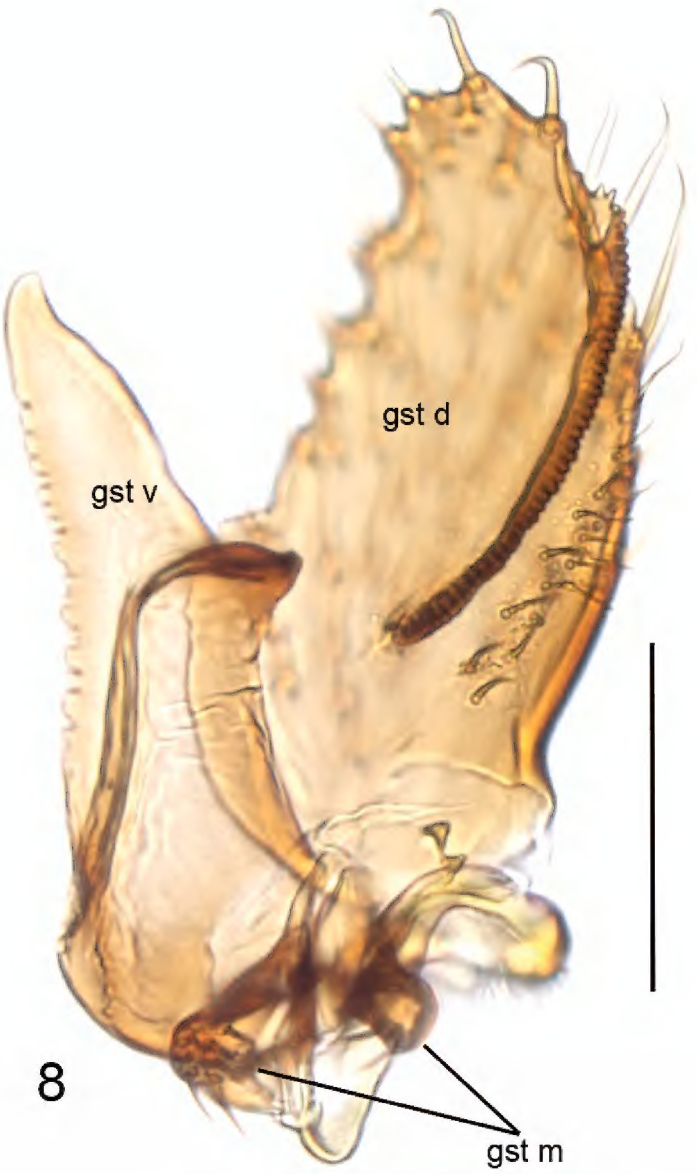
Etymology. The species is named to indicate its occurrence at high altitude (2730 m a.s.l.): Latin *monticola* means "mountain dweller". The specific epithet is noun in apposition.

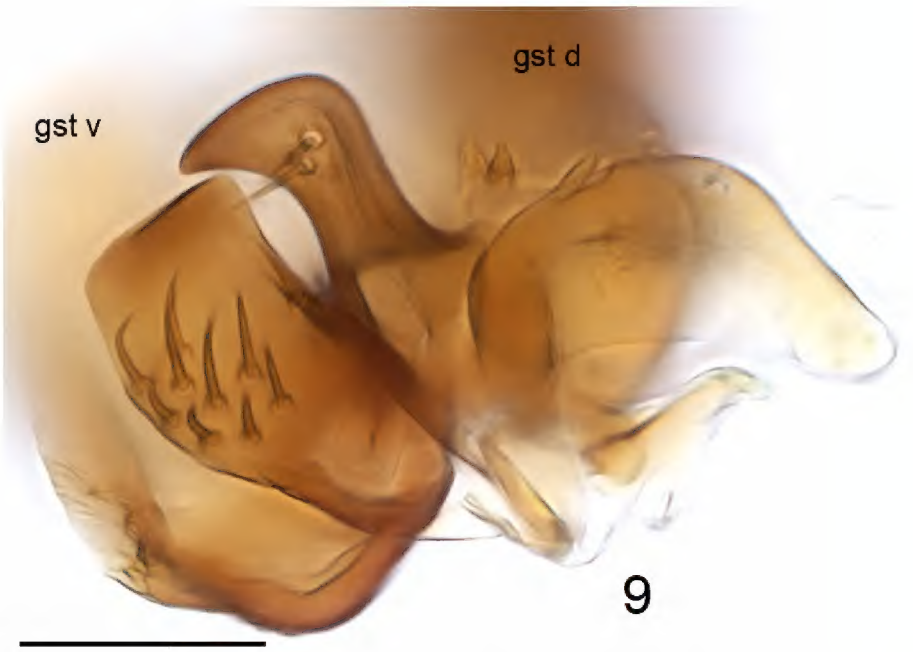
Comments. The paratype has seemingly 14 flagellar segments at one side, caused by an aberrantly divided apical one. This, as well as partial fusion of some flagellar segments unilaterally, is common and frequently observed in the Palaearctic specimens of the genus (OK *pers. obs.*). According to the structure of male terminalia, especially in



Figures 3–7. *Cordyla monticola* sp. n., male terminalia. **3** ventral view **4** lateral view **5** dorsal view **6** sternite VIII, ventral view **7** hypoproct, ventral view. Scale bars: 0.1 mm (**3, 4, 5, 6**) and 0.05 mm (**7**). Abbreviations: cerc = cercus; epi = epiproct; gc = gonocoxite; gst d = dorsal branch of gonostylus; gst v = ventral branch of gonostylus; hyp = hypoproct; st VIII = sternite VIII.

having the medial branch of the gonostylus divided into two subequal lobes, the species belongs to the *C. murina* species-group as defined by Kurina (2001). Within the group, *C. monticola* sp. n. shares a 13-segmented flagellum and brown to dark brown swollen antepenultimate palpal segment with two Palaearctic (viz. *C. semiflava* Staeger, 1840 and *C. borealisa* Wu in Wu & Zheng, 2000) and three Nearctic (*C. manca* Johannsen, 1912, *C. scita* Johannsen, 1912 and *C. gracilis* Fisher, 1938) species. *Cordyla semiflava, C. borealisa* and *C. manca* have the sternite VIII subapically remarkably





Figures 8–9. *Cordyla monticola* sp. n., gonostylus. **8** internal view **9** lobes of medial branch of gonostylus. Scale bars: 0.1 mm (**8**) and 0.05 (**9**). Abbreviations: gst d = dorsal branch of gonostylus; gst m = medial branch of gonostylus; gst v = ventral branch of gonostylus.

constricted, while it is smoothly tapering in *C. monticola* sp. n. The shape of the lobes of medial branch of the gonostylus and the hypoproct are different from those in all species of the group.

***Cordyla pseudopusilla* sp. n.**
http://zoobank.org/1EF47BC4-2CCE-449D-B9D7-95165BBC79FA
Figs 10–23, 38

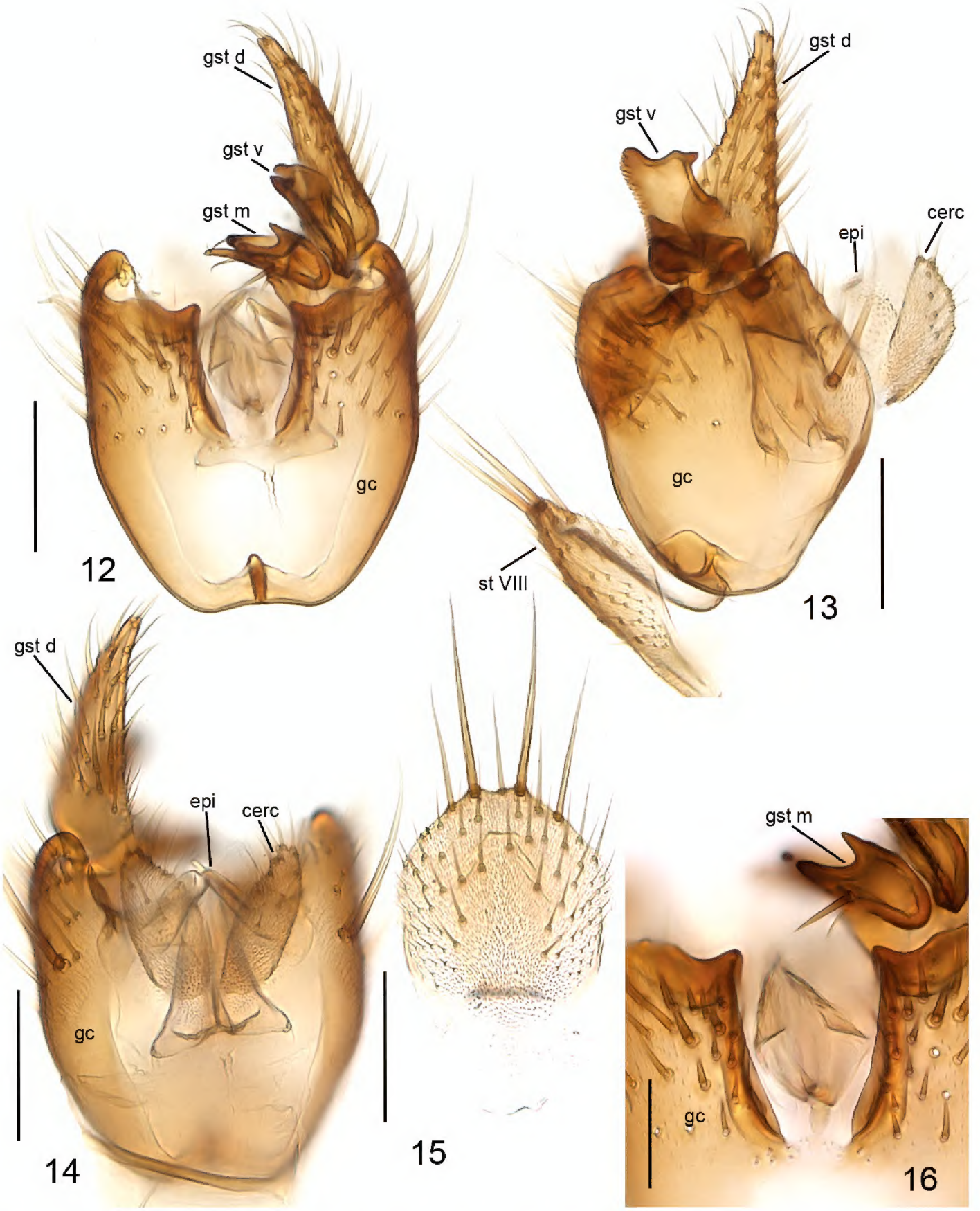
Type material. *Holotype.* ♂, COLOMBIA Boyacá / SFF Iguaque El Níspero / 05°38'N 73°31'W 2730 m / Malaise 1 13-28.x.2001 / P. Reina Leg. M. 2475 [IAvH]. *Paratypes.* 1♂, same as holotype except 28.x-14.xi.2001, M. 2482 [IAvH]; 1♂ 2♀♀, same as holotype except 2 07-21.xii.2001, M. 2585 [1♂ 1♀ at MZUSP, 1♀ at IAvH]; 1♂ 1♀, same as holotype except 19.i-03.ii.2002, M. 3067 [IZBE]; 1♂, same as holotype except 3-18.ii.2002, M. 3068 [IAvH].

Description. Male (Fig. 10)**.** Total length 2.9–3.4, 3.2 [3.4] mm (n=5).

Head (Fig. 11) dark yellow, mouthparts somewhat paler. Two ocelli encircled by brown areas, close to compound eyes. All three visible palpal segments (Fig. 11) setose, swollen antepenultimate segment light brown to brown, succeeding segments pale. 4th segment slightly widening apically, 5th segment apically tapering. Swollen palpal segment 1.8–2.2, 2.0 [1.8] times as long as broad medially from lateral view, and as long as height of compound eye. Ratios of three apical palpomeres 1.0: 0.8: 1.0. Antenna with 2+10 segments. Scape and pedicel yellow, flagellum somewhat darker, all with brown setosity. Scape elongate cup-shaped, 1.9–2.3, 2.1 [2.0] times as long as wide apically. Pedicel cup-shaped, 0.6–0.8, 0.7 [0.6] times as long as wide apically. Flagellomeres rectangular, about twice as wide as long. Apical flagellomere conical, about 2.2 times as long as wide basally. **Thorax** yellow, mesonotum medially somewhat darker. Hind margin of laterotergite narrowly brown. Katepisternum lighter. Anterior part of mesepimeron with a brown patch leaving anteroapical corner yellow. Haltere with a pale knob, stem basally pale and darker. All setosity on thorax brown. Scutum entirely covered with decumbent setae, scutellum with setae including two pairs of marginal bristles, laterals considerably shorter than internals. Antepronotum with setae including 5–7 [7] bristles, proepisternum with setae including 4–7 [7] bristles. Anepisternum with 4 bristles at hind margin and with ca. 40 setae on its upper two thirds. Mesepimeron and katepisternum bare. Laterotergite with 2–3 [3] bristles medially and ca. 10 setae along upper margin. Mediotergite bare. Metepisternum with 5–6 [5] bristles and ca. 10 setae. **Wing** with yellowish tinge, otherwise clear. Length 2.2–2.5, 2.4 [2.4] mm (n=10). Ratio of length to width 2.4–2.7, 2.6 [2.4]. All veins light brown. Radial veins seem darker because of setae on both surfaces; other veins bare. Crossvein r-m apically disjunct. M1+2 5–6 times as long as r-m. M2 not reaching wing margin, broken 0.5–0.7, 0.6 [0.5] times of M1+2 length before it. M1 and M4 apically very faint. Posterior fork begins clearly before anterior fork. **Legs** yellow, hind femora slightly infuscated at apical fifth. Tarsi seem darker because of dense brown setae. Hind coxa with 2–3 [3] posterolateral bristles basally, with one posterior bristle apically, and with ca. 10 weaker setae along posterolateral margin. Ratio of femur to tibia for fore-, mid- and hind legs: 1.5–1.6, 1.6 [1.5]; 1.0–1.1, 1.1 [1.1]; 1.0, 1.0 [1.0]. Ratio tibia to first tarsomere for fore-, mid- and hind legs: 1.0–1.1, 1.0 [1.0]; 1.1–1.3, 1.2 [1.1]; 1.4–1.5, 1.5 [1.4]. Fore-tibia with a spur about 0.5–0.6, 0.5 [0.6]

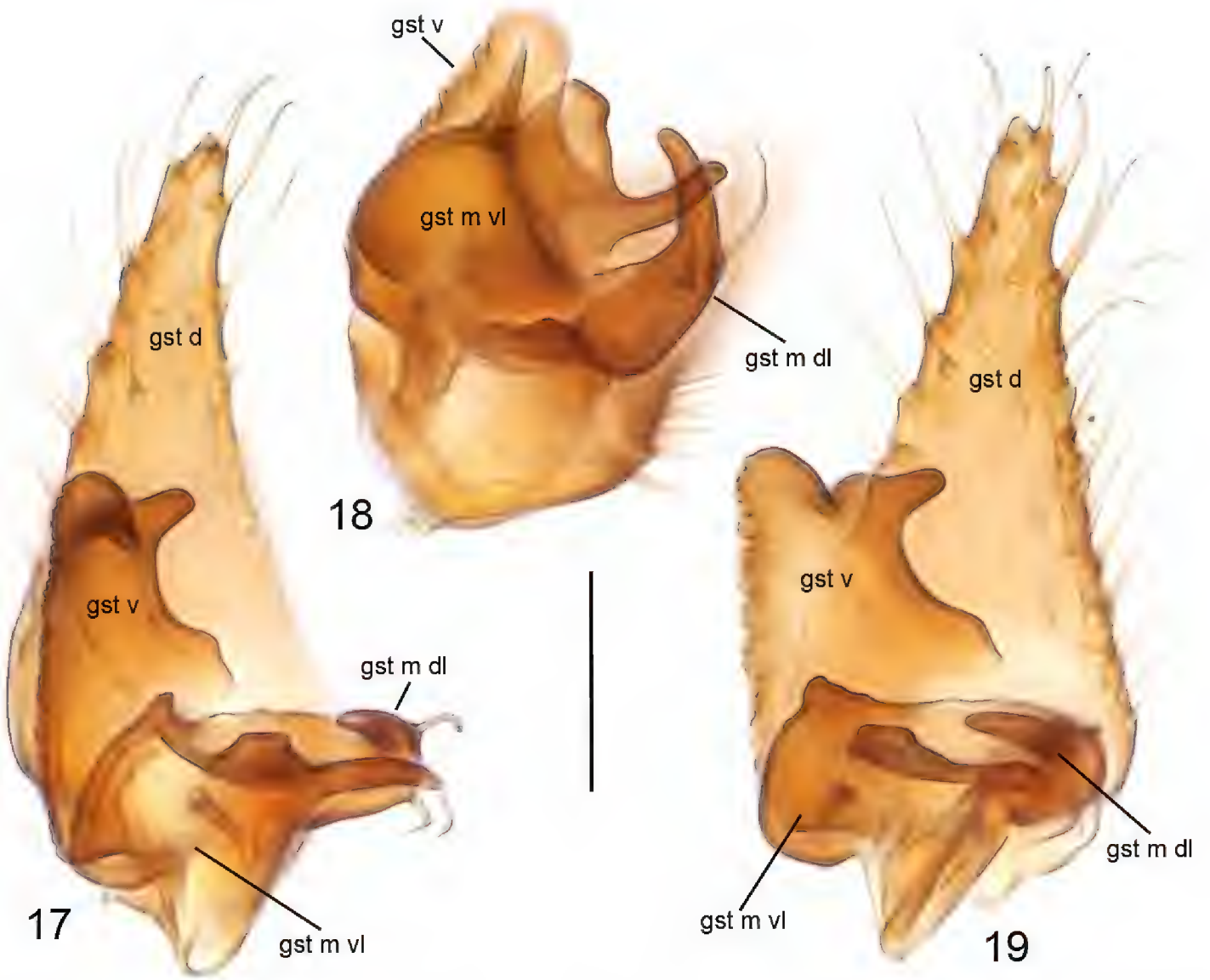
Figures 10–11. *Cordyla pseudopusilla* sp. n. **10** male habitus **11** head with antennae and maxillary palpi, closer view. Scale bars: 1 mm (**10**) and 0.2 mm (**11**).

of fore basitarsus; mid-tibia with anterior spur about 0.3, 0.3 [0.3] and with posterior spur about 0.6–0.7, 0.7 [0.7] of mid basitarsus; hind tibia with anterior spur about 0.5 and with posterior spur about 0.6 of hind basitarsus. **Abdomen** with first segment light brown, and 2–4 segments dorsally brownish, laterally yellow and ventrally pale yellow; succeeding segments entirely brown. **Terminalia** (Figs 12–19) with basal part of gonocoxite and cerci yellow; apical part of gonocoxite slightly darker; dorsal branch of gonostylus yellow; ventral and medial branches of gonostylus brown. Sternite 8 oblong, apical fourth conical, apex truncated, basal half membranous and bare, setae on apical quarter somewhat stronger than other setae, two apical setae well deviating from other setosity. Gonocoxite subquadrate, with narrow ventral incision about half height of gonocoxite. Ventral medial margin of gonocoxite apically angular and with membranous formations dorsad from the ventral surface of gonocoxite. Dorsal medial margin of gonocoxite simple. Cerci setose, setae on medial margin slightly stronger, deviating from other setosity; clearly separated, prolonged, subapically somewhat constricted, not protruding over gonocoxite. Basal half of gonocoxite bare, apical half with strong bristles. Dorsal branch of gonostylus elongated, tapering, without sclerotized comb, dorsal surface with homogeneous setosity. Ventral branch of gonostylus bare, about half as long as dorsal branch, with serrated lateral margin. Apical corners of ventral branch of gonostylus drawn out to small lobes: ventral wider and rounded, dorsal



Figures 12–16. *Cordyla pseudopusilla* sp. n., male terminalia. **12** ventral view **13** lateral view **14** dorsal view **15** sternite VIII, ventral view **16** ventromedial incision of gonocoxite, ventral view. Scale bars: 0.1 mm (**12, 13, 14, 15**) and 0.05 mm (**16**). Abbreviations: cerc = cercus; epi = epiproct; gc = gonocoxite; gst d = dorsal branch of gonostylus; gst m = medial branch of gonostylus; gst v = ventral branch of gonostylus; st VIII = sternite VIII.

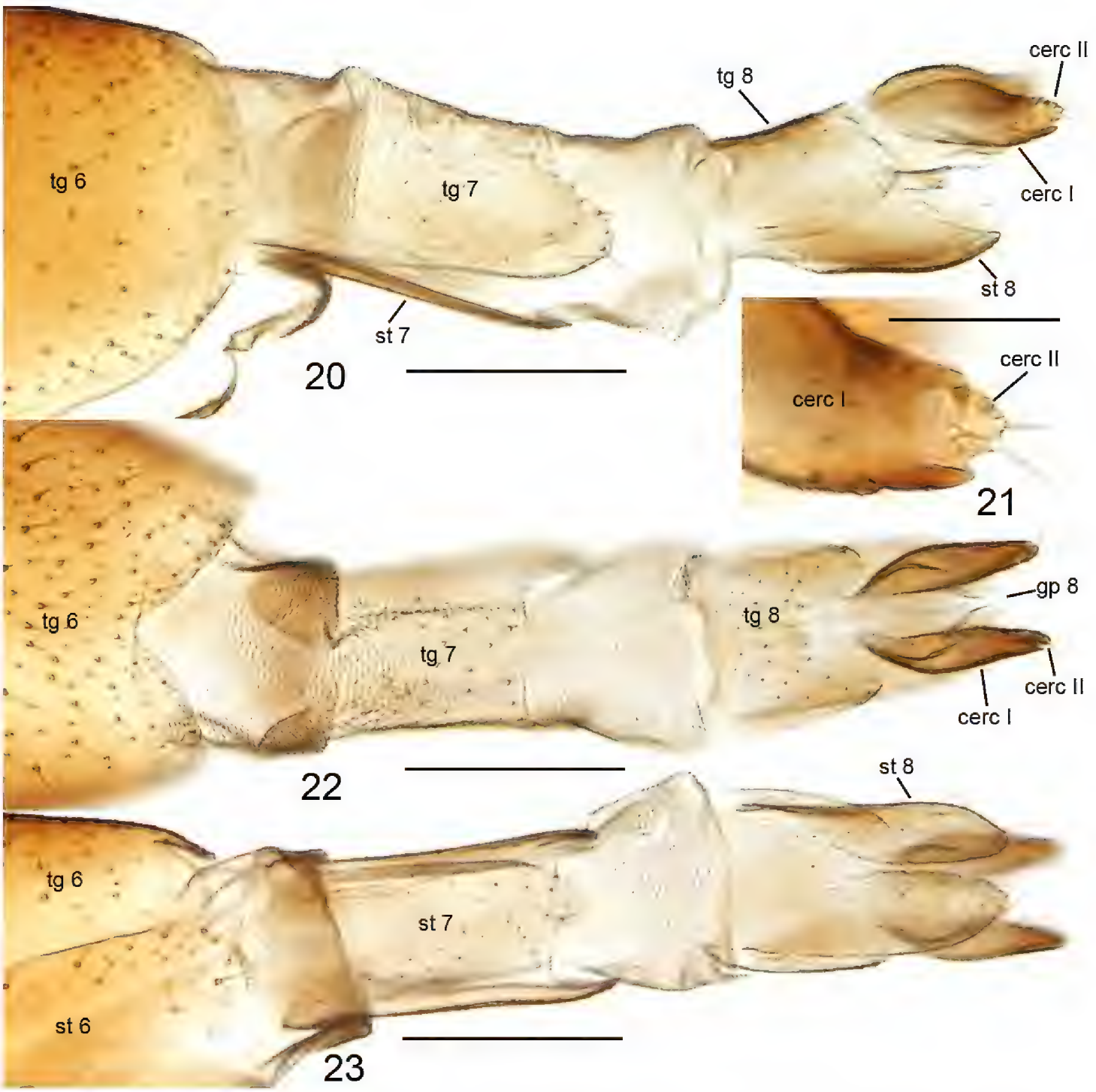
narrow. Dorsal margin of ventral branch of gonostylus with wide and shallow incision. Medial branch of gonostylus divided into two lobes: 1) ventral lobe with three apical protrusions separated by concavities (ventral finger-like protrusion well discernible at



Figures 17–19. *Cordyla pseudopusilla* sp. n., gonostylus **17** ventral view **18** anterior view of medial branch **19** internal view. Scale bars: 0.05 mm. Abbreviations: gst d = dorsal branch of gonostylus; gst m dl = dorsal lobe of medial branch of gonostylus; gst m vl = ventral lobe of medial branch of gonostylus; gst v = ventral branch of gonostylus.

internal view), internal surface with one strong and three weaker setae, and 2) dorsal lobe curved, tapering, as long as the medial protrusion of ventral lobe and with three medial setae. Epiproct apically rounded, covered with small setulae. Hypoproct indiscernible.

Female. Total length 3.6–3.7, 3.6 mm (n=3). Wing length 2.4–2.5, 2.4 mm. Ratio of length to width 2.4–2.6, 2.5. Antennae 2+9 segments. In setosity and coloration similar to male. Terminalia (Figs 20–23) light brown. Cercus two-segmented: apical segment small, sunken into basal segment, with 2-3 long setae deviating from other setosity; basal segment long ovate, slightly sinusoidal and considerably wider than apical segment. Gonapophysis VIII membranous, visible in dorsal view. Tergite VIII rectangular, subequal to length of basal segment of cercus, apically angular in lateral view, basally and apically well emarginated in dorsal view. Sternite VIII tapering lateroapically, with deep medial cleft in ventral view. Tergite VII longer than tergite VIII, basally and apically well emarginated in dorsal view. Sternite VII apically conical, subequal to length of tergite VII. Tergite VI apically rounded in lateral view and with apicodorsal incision.



Figures 20–23. *Cordyla pseudopusilla* sp. n. female terminalia. **20** lateral view **21** cerci, closer view **22** dorsal view **23** ventral view. Scale bars: 0.2 mm (**20, 22, 23**) and 0.05 mm (**21**). Abbreviations: cerc = cercus, gp = gonapophysis, st = sternite, tg = tergite.

Biology. Unknown.

Etymology. The specific name is derived by the Greek prefix *pseudo–* from the Palaearctic species *Cordyla pusilla* Edwards, 1925 to indicate their morphological similarity.

Comments. Belonging to the *C. fusca* species-group (cf. Kurina 2001), *C. pseudopusilla* sp. n. shares a 10-segmented flagellum and brown to dark brown swollen antepenultimate segment of palpus with five Palaearctic (viz. *C. bomloensis* Kjærandsen & Kurina, 2004, *C. brevicornis* Staeger, 1840, *C. geminata* Sasakawa, 2005, *C. pusilla* and *C. triloba* Sasakawa, 2008) and three Nearctic (viz. *C. neglecta* Johannsen, 1912, *C. recens* Johannsen, 1912, *C. scutellata* Garrett, 1925) species. Within these, the new species is remarkably similar to *C. pusilla* and *C. neglecta*. All three species have the

ventral branch of gonostylus subquadrate with emarginated dorsal margin. However, the emargination is more pronounced in *C. pseudopusilla* sp. n. The new species has the medial branch of the gonostylus with a curved dorsal lobe (straight in the other two species) and with deep concavities on the ventral lobe apically (more shallow in the other two species).

***Cordyla reducta* sp. n.**
http://zoobank.org/8FBF8F6C-601E-4CE3-80D7-39E72B2108C5
Figs 24–38

Type material. *Holotype.* ♂, COLOMBIA, Risaralda SFF / Otún Quimbaya Robledal / 04°44'N 75°35'W 1980 m /Malaise 04–20.iii.2003 / G. López Leg. M. 3686 [IAvH]. *Paratypes.* 1♂ 2♀♀, same as holotype [IAvH]; 1♂, Boyacá / SFF Iguaque El Níspero / 05°38'N 73°31'W 2730 m / Malaise 2 07-21.xii.2001 / P. Reina Leg. M. 2585 [IAvH]; 4♂♂ 2♀♀, Valle del Cauca / PNN Farallones de Cali / Cgto. La Meseta / 03°34'N 76°40'W 1960 m / Malaise 09-26.x.2003 / S. Sarria & M. Losso Leg. M. 4548 [IZBE]; 1♂, Valle del Cauca / PNN Farallones de Cali / Cgto. La Meseta / 03°34'N 76°40'W 1960 m / Malaise 27.viii-10.ix.2003 / S. Sarria & M. Losso Leg. M. 4549 [IAvH]; 1♂ 2♀♀, Valle de Cauca / PNN Farallones de Cali Cgto. / La Meseta 03°34'N 76°40'W 2200 m / Malaise 26.xi-10.xii.2003 / S. Sarria & M. Losso Leg. M. 4562 [MZUSP]; 2♂♂, COLOMBIA, Risaralda SFF / Otún Quimbaya Robledal / 04°44'N 75°35'W 1980 m Malaise 20.iii-04.iv.2003 / G. López Leg. M. 3682 [MZUSP]; 1♀, Risaralda SFF / Otún Quimbaya Urapanera / 04°44'N 75°35'W 1960 m Malaise 20.iii–04.iv.2003 / G. López Leg. M. 3688 [IAvH]; 1♂ 3♀♀, Risaralda SFF / Otún Quimbaya Robledal / 04°44'N 75°35'W 1980 m Malaise 18.ii-04.iii.2003 / G. López Leg. M. 3699 [IAvH]; 1♀, Risaralda SFF / Otún Quimbaya Robledal / 04°44'N 75°35'W 1980 m Malaise 04-19.iv.2003 / G. López Leg. M. 3710 [IAvH]; 5♂♂ 3♀♀ COLOMBIA, Risaralda SFF / Otún Quimbaya Robledal / 04°44'N 75°35'W 1980 m Malaise 11-27.x.2003 / G. López Leg. M. 4182 [3♂♂ 2♀♀ MZUSP, 2♂♂ 1♀ IZBE].

Description. Male (Fig. 24)**.** Total length 2.5–3.2, 2.9 [3.2] mm (n=10).

Head (Fig. 25) dark yellow, mouthparts somewhat paler. Two ocelli encircled by brown areas, close to compound eyes. All three visible palpal segments (Fig. 25) setose, swollen antepenultimate segment dark yellow, succeeding segments pale. 4th segment slightly widening apically, 5th segment apically tapering. Swollen palpal segment 2.3–2.6, 2.4 [2.5] times as long as broad medially from lateral view, and 1.1–1.3, 1.2 [1.1] times as long as height of compound eye. Ratios of three apical palpomeres 1.0: 0.7: 1.0–1.1, 1.0 [1.1]. Antenna yellow with 2+12 segments. Scape and pedicel with brown setae, flagellum with somewhat paler setosity. Scape elongate cup-shaped, 1.8–2.2, 2.0 [1.9] times as long as wide apically. Pedicel cup-shaped, 0.7–0.9, 0.8 [0.9] times as long as wide apically. Flagellomeres rectangular, about twice as wide as long. Apical flagellomere conical, about 1.7 times as long as wide basally. **Thorax**

Figures 24–25. *Cordyla reducta* sp. n. **24** male habitus **25** head with antennae and maxillary palpi, closer view. Scale bars: 1 mm (**24**) and 0.2 mm (**25**).

yellow, mesonotum medially somewhat darker. Hind margin of laterotergite narrowly brown. Anterior part of mesepimeron with a brown patch. Haltere with knob apically pale and basally brownish, and pale stem. All setosity on thorax brown. Scutum entirely covered with decumbent setae, scutellum with setae including two pairs of marginal bristles, laterals considerably shorter than internals. Antepronotum with setae including 2–3 [3] bristles, proepisternum with setae including 3–5 [5] bristles. Anepisternum with 3–4 [4] bristles at hind margin and with ca. 45 setae on its upper two thirds. Mesepimeron and katepisternum bare. Laterotergite with 2 bristles and ca. 15 setae on upper half. Mediotergite bare. Metepisternum with 2–4 [4] bristles and ca. 10 setae. **Wing** with yellowish tinge, otherwise clear. Length 2.0–2.3, 2.2 [2.3] mm (n=10). Ratio of length to width 2.6–2.9, 2.7 [2.9]. All veins light brown. Radial veins seem darker because of setae on both surfaces; other veins bare, except about 5 setae on dorsal surface of M4. Crossvein r-m apically disjunct. M1+2 3–4 times as long as r-m. R5 slightly sinusoid. M2 not reaching wing margin, broken 0.7–1.0, 0.8 [0.9] times of M1+2 length before it. Posterior fork begins clearly beyond anterior fork. **Legs** yellow, hind femora slightly infuscated at apical fifth. Tarsi seem darker because of dense brown setae. Hind coxa with 2–4 [4] posterolateral bristles basally, with one posterior bristle apically, and with ca. 25 weaker setae along posterolateral margin. Ratio of femur to tibia for fore-, mid- and hind legs: 1.3–1.6, 1.4 [1.4]; 0.8–1.0, 0.9 [1.0]; 1.0, 1.0 [1.0]. Ratio tibia to first tarsomere for fore-, mid- and hind legs: 1.0–1.1, 1.0 [1.0]; 1.1–1.3, 1.2 [1.2]; 1.4, 1.4 [1.4]. Fore-tibia with a spur about 0.5–0.6, 0.5 [0.6] of fore basitarsus; mid-tibia with anterior spur about 0.3 and with posterior

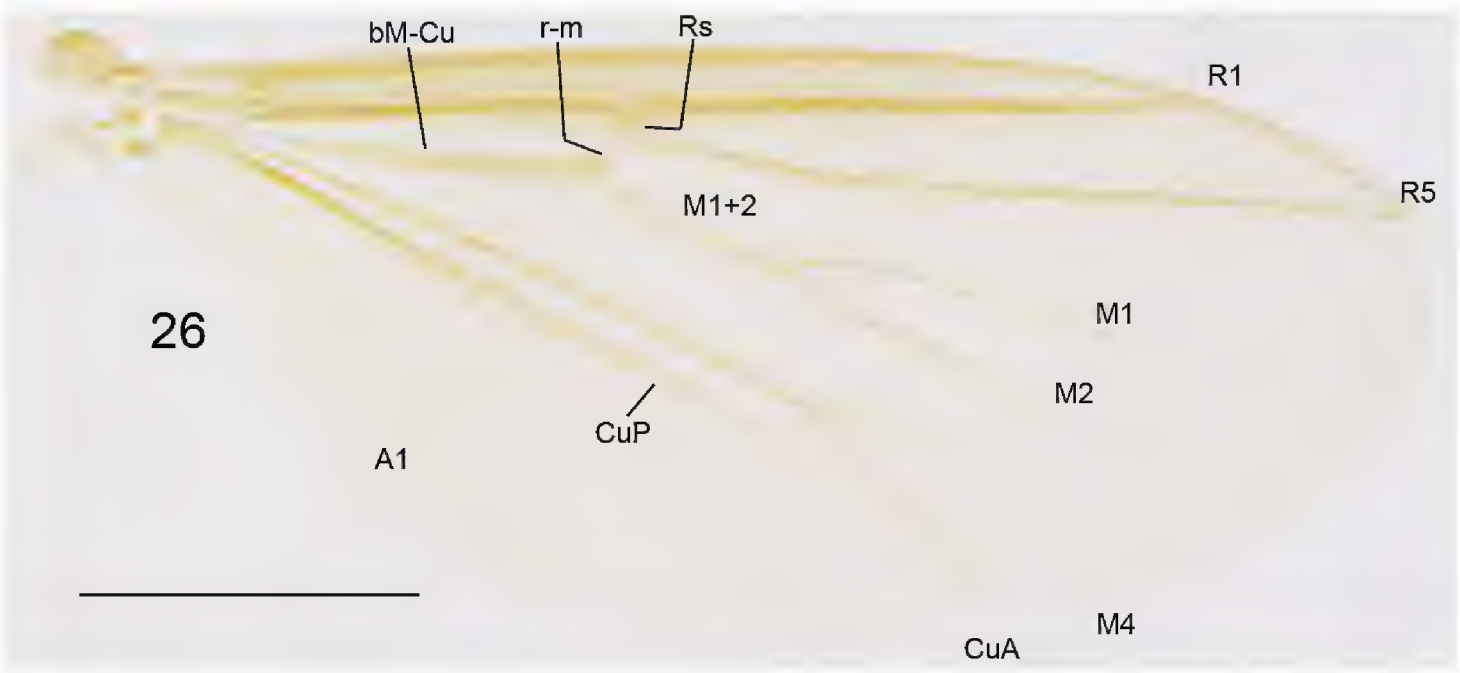
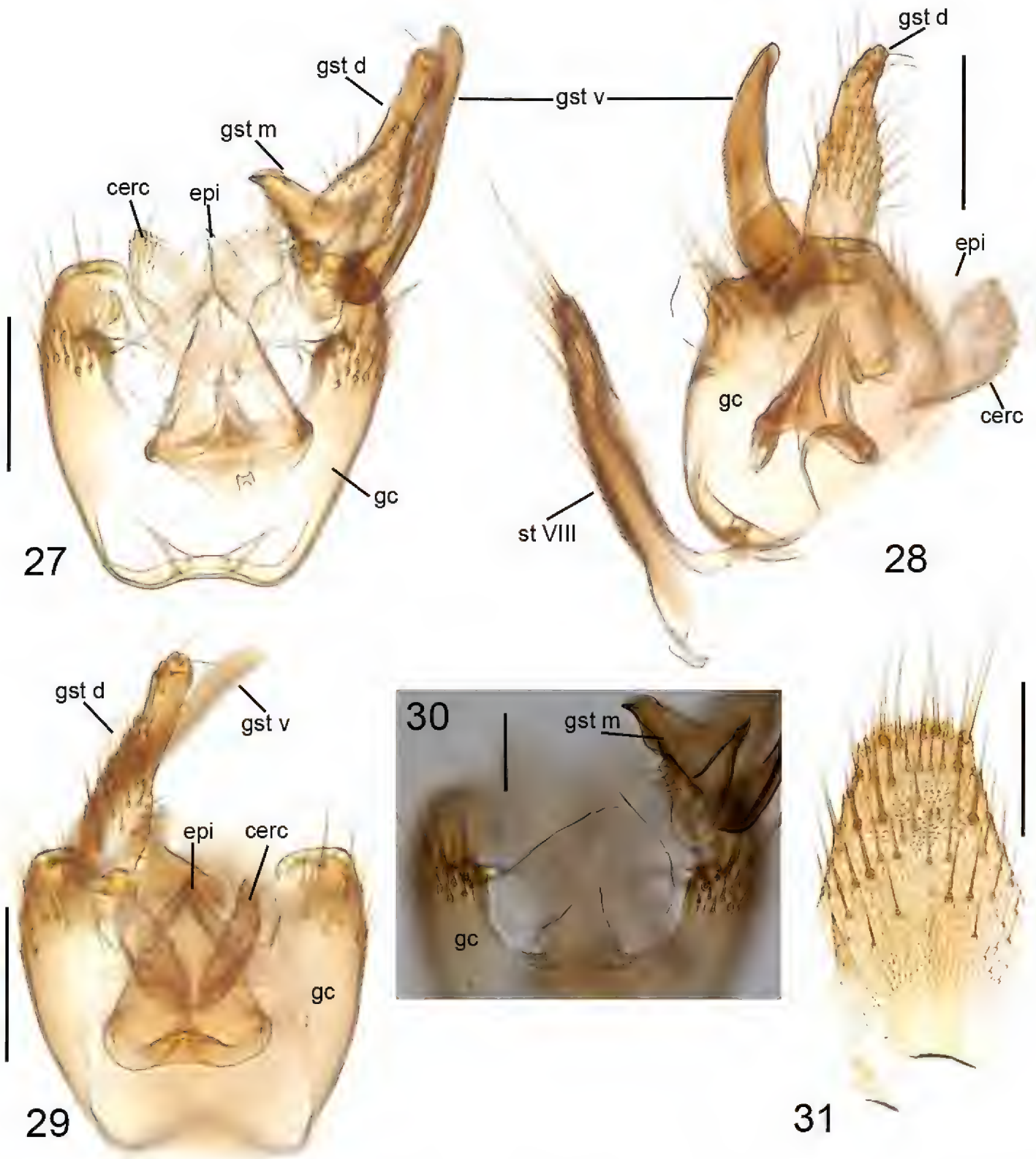


Figure 26. *Cordyla reducta* sp. n. **26** female wing. Scale bars: 0.5 mm.

spur about 0.6–0.7, 0.7 [0.6] of mid basitarsus; hind tibia with anterior spur about 0.6 and with posterior spur about 0.6–0.7, 0.7 [0.6] of hind basitarsus. **Abdomen** with first 3 segments dorsally brownish, laterally yellow and ventrally pale yellow; succeeding segments brown, only slightly lighter laterally and ventrally. **Terminalia** (Figs 27–33) with gonocoxite and cerci yellow; gonostylus brownish; sternite 8 seems brownish because of dense setosity. Sternite 8 oblong with truncated apex, basal third membranous and bare, setae on apical quarter somewhat stronger than rest of them. Gonocoxite subquadrate, with broad ventral incision about half of gonocoxite height. Ventral incision of gonocoxite with apically rounded basal hump about one third height of incision. Ventral medial margin of gonocoxite angular with apically pointed membranous formations dorsad from the ventral surface of gonocoxite. Dorsal medial margin of gonocoxite bulging. Cerci setose, setae on medial margin stronger, deviating from other setosity; clearly separated, prolonged, subapically somewhat constricted, not protruding over gonocoxite. Basal half of gonocoxite bare, apical half with strong bristles. Dorsal branch of gonostylus oblong, basally wider, apically slightly tapering, with a sclerotized comb of about one fifth branch height on its ventral surface. Setosity on basal two thirds more dense, leaving subapical area almost bare; apical setae slightly stronger than other setosity of the branch. Ventral branch of gonostylus bare, basally bulbous and apically rounded, slightly curved, longer than dorsal branch, with serrated lateral margin. Medial branch of gonostylus hump-backed, not divided into lobes but medially extended, and with 5–6 strong setae at medial margin ventrobasally. Epiproct abruptly narrowing subapically, with pointed apex, covered with small setulae. Hypoproct indiscernible.

Female. Total length 2.5–3.4, 2.9 mm. Wing length 1.7–2.5, 2.1 mm. Ratio of length to width 2.4–2.7, 2.6. Antennae 2+9 segments. In setosity and coloration similar to male, except for entirely pale second abdominal segment. Both M1 and M2 not reaching wing margin, M4 extremely faint at its distal part (Fig. 26). Terminalia



Figures 27–31. *Cordyla reducta* sp. n., male terminalia. **27** ventral view **28** lateral view **29** dorsal view **30** ventromedial incision of gonocoxite, ventral view **31** sternite VIII, ventral view. Scale bars: 0.1 mm (**27, 28, 29, 31**) and 0.05 mm (**30**). Abbreviations: cerc = cercus; epi = epiproct; gc = gonocoxite; gst d = dorsal branch of gonostylus; gst m = medial branch of gonostylus; gst v = ventral branch of gonostylus; st VIII = sternite VIII.

(Figs 34–37) light brown. Cercus two-segmented: apical segment small, with a few long setae deviating from other setosity, obliquely connected with basal segment; basal segment long ovate, sinusoidal and wider than apical segment, ventroapical corner drawn out to a setose small lobe. Gonapophysis VIII membranous, visible in ventral view, apically rounded. Tergite VIII rectangular, subequal to length of basal segment

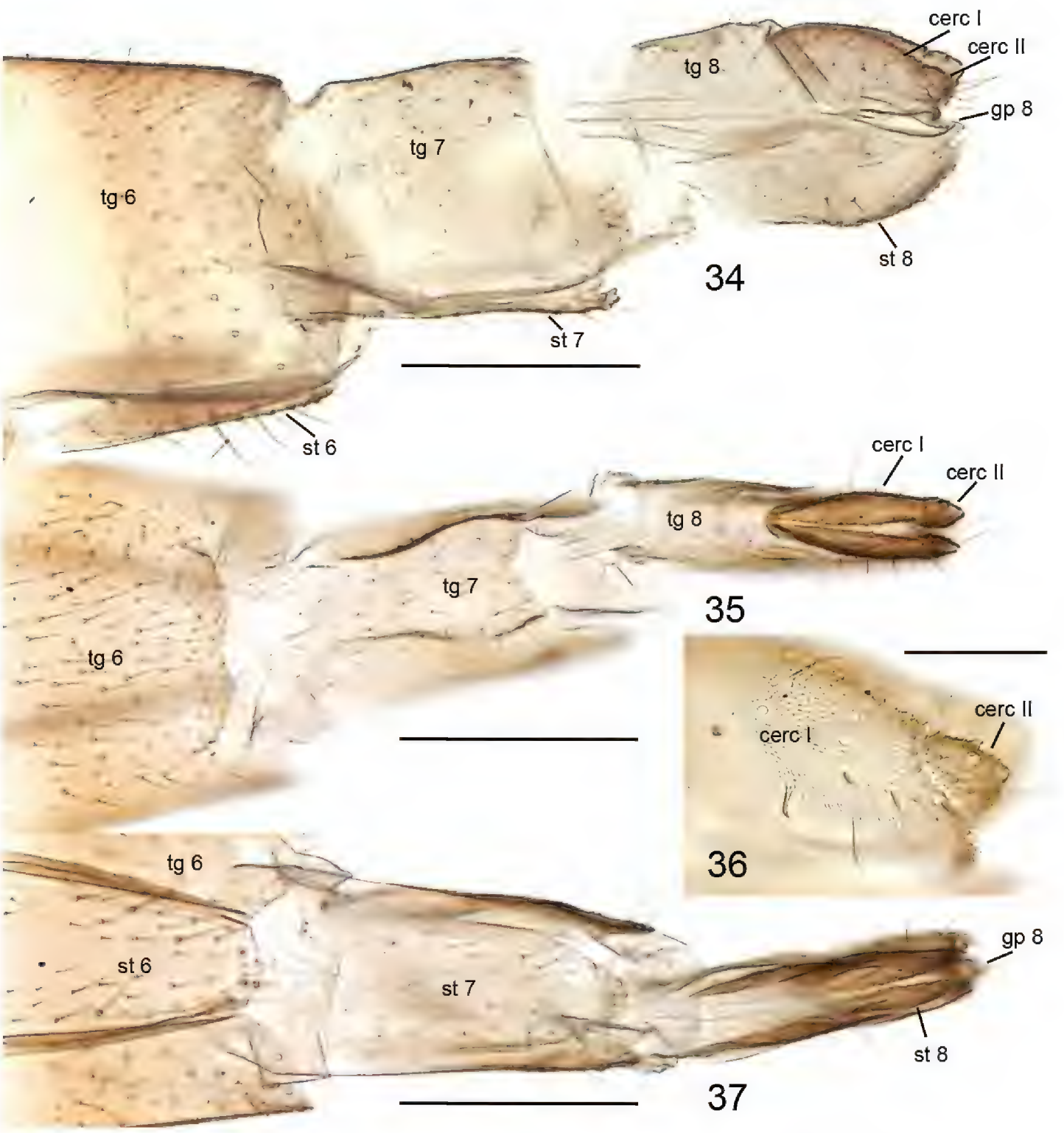
Figures 32–33. *Cordyla reducta* sp. n., gonostylus **32** internal view **33** ventral view. Scale bars: 0.05 mm. Abbreviations: gc = gonocoxite; gst d = dorsal branch of gonostylus; gst m = medial branch of gonostylus; gst v = ventral branch of gonostylus.

of cercus, apically angular, basally and apically emarginated in dorsal view. Sternite VIII tapering lateroapically, with deep medial cleft in ventral view. Tergite VII about twice as long as tergite VIII, apically widening and with apical incision in dorsal view. Sternite VII apically conical, subequal to length of tergite VII. Tergite VI apically emarginated in dorsal view.

Biology. Unknown.

Etymology. The specific name refers to the distally extremely reduced medial veins of the female wing: from Latin *reducta* meaning "distant". An adjective.

Comments. By the structure of male terminalia, *C. reducta* sp. n. belongs to the *C. fusca* species-group (cf. Kurina 2001). In its 12-segmented flagellum and yellow to light brown swollen antepenultimate segment of palpus, the new species is similar to the Palaearctic *C. flaviceps* (Staeger, 1840) and Oriental *C. borneoensis* Kurina, 2005.



Figures 34–37. *Cordyla reducta* sp. n. female terminalia. **34** lateral view **35** dorsal view **36** cerci, closer view **37** ventral view. Scale bars: 0.2 mm (**34, 35, 37**) and 0.05 mm (**36**). Abbreviations: cerc = cercus, gp = gonapophysis, st = sternite, tg = tergite.

The male terminalia of *C. reducta* sp. n. are remarkably different from these two species but otherwise resemble the Palaearctic *C. fasciata* Meigen, 1818 in having a similar outline to the ventral and dorsal branches of the gonostylus. However, the medial branch of the gonostylus is hump-backed and medially extended in *C. reducta* sp. n., while it has two small medial lobes in *C. fasciata* (cf. Zaitzev 2003: fig. 21–27). All studied female specimens have both medial veins of the wing distally extraordinary reduced (Fig. 26), unique among the species worldwide.

Figure 38. Collecting localities of *Cordyla* species in Colombian Andes. **1** "Parque Nacional Natural Farralones de Cali" **2** "Santuario de Flora y Fauna Otún Quimbaya" **3** "Santuario de Flora y Fauna Iguaque".

Discussion

Herein we present the occurrence of the genus *Cordyla* from the Colombian Andes (Fig. 38), representing the first described species in the Neotropical region. However, according to Vockeroth (2009: 276), unidentified specimens of *Cordyla* were previously known from Mexico, Belize, Guatemala, and Costa Rica. We were able to study the material housed at the Instituto Nacional de la Biodiversidad (INBio), San Jose, Costa

Rica, that includes eight females from the provinces of Guanacaste, San José, Heredia, Puntarenas, and Limón (Vockeroth 2009; SSO pers. obs.). Because of the absence of associated male specimens, the formal description of species from that material has not been performed at the moment.

The presence of *Cordyla* in the north-western part of Colombia, in the Neotropical region, clearly corresponds to a secondary extension of a Nearctic clade to the south. The range of this extension is, however, restricted to the mountains of Colombian Andes. In spite of having studied a vast fungus gnat material from the Amazonian basin, the genus has not been recorded there (SSO, OK pers. obs.). This distribution pattern is actually not restricted only to *Cordyla* within the Mycetophilidae. Also *Docosia adusta* Oliveira & Amorim, 2011 belongs to a group of Nearctic mycetophilid species reaching Colombia. According to regionalization of the Neotropical region by Morrone (2014), two of the three localities ("PNN Farralones de Cali" and "SFF Otún Quimbaya") lie in the Pacific Dominion and "SFF Iguaque" is located in the South American transition zone called Paramo province. *Cordyla reducta* sp. n. was recorded from all three localities while *C. monticola* sp. n. and *C. pseudopusilla* sp. n. are in the present stage of knowledge endemic to the Paramo province only (Fig. 38).

The complexity of the overlap of different biogeographical elements in Colombia was highlighted by Oliveira et al. (2007) and Oliveira and Amorim (2011). The Colombian fauna encompasses elements of Nearctic origin (p. ex. *Docosia adusta*), tropical origin, and a number of typical circum-antarctic elements that reach the north-western part of Neotropical region following the Andes final uplift to the north. The genera *Paraleia* Tonnoir, of which six new species were recently described from the Colombian Andes (Oliveira and Amorim 2012), and *Procycloneura* Edwards, of which at least ten species are being described by Oliveira and Amorim (in prep.) from Colombia and Costa Rica, are examples of amphinotic elements in Colombian fauna. Further studies of the diversity of Mycetophilidae and *Cordyla* in the Andes would contribute to a better understanding of the distributional patterns into the family and, hence, the biogeographical evolution of the region.

Acknowledgements

OK was supported by the grant 9174 of the Estonian Science Foundation and by institutional research funding (IUT21-1) of the Estonian Ministry of Education. SSO was supported by the FAPESP grants 2008/52324-6 and 2012/51577-3. We are very grateful to Peter Chandler (Melkshamn, United Kingdom) for critical perusal of the manuscript. Dr. Jukka Salmela (Rovaniemi, Finland) and Dr. Alexei Polevoi (Petrozavodsk, Russia) are thanked for their suggestions on the manuscript.

References

Amorim DS, Rindal E (2007) A phylogenetic study of the Mycetophiliformia, with creation of the subfamilies Heterotrichinae, Ohakuneinae, and Chiletrichinae for the Rangomaramidae (Diptera, Bibionomorpha). Zootaxa 1535: 1–92.

Edwards FW (1925) British Fungus-Gnats (Diptera, Mycetophilidae). With a revised Generic Classification of the Family. Transactions of the Entomological Society of London 73 (1924): 505–670.

Fisher EG (1938) North American fungus gnats. II (Diptera: Mycetophilidae). Transactions of the American Entomological Society 64: 195–200.

Garrett CBD (1925) Seventy New Diptera. Privately published, Cranbrook, British Columbia, 1–16.

Hippa H, Kurina O (2012) New species and new records of Afrotropical *Manota* Williston (Diptera, Mycetophilidae), with a key to the species. Zootaxa 3455: 1–48.

Johannsen OA (1912) The Mycetophilidae of North America. Part III. Maine Agricultural Experiment Station Bulletin 196: 249–328.

Kjærandsen J (2006) Review of fungus gnats of the genus *Tarnania* Tuomikoski, with a phylogeny of the *Rymosia* s.l. genus group (Diptera: Mycetophilidae). Insect Systematics & Evolution 37: 121–148. doi: 10.1163/187631206788831146

Kjærandsen J, Kurina O (2004) A new species of *Cordyla* Meigen from Norway (Diptera: Mycetophilidae). Norwegian Journal of Entomology 51: 137–143.

Kurina O (2001) On the identification of Palaearctic species in the genus *Cordyla* Meigen (Diptera, Mycetophilidae); preliminary results. Norwegian Journal of Entomology 48: 231–235.

Kurina O (2003) Notes on the Palaearctic species of the genus *Polylepta* Winnertz (Diptera: Mycetophilidae) with a new synonymization. Entomologica Fennica 14(2): 91–97.

Kurina O (2005) Three new species of *Cordyla* Meigen (Diptera: Mycetophilidae) from Borneo, Sulawesi and Papua New Guinea. Annales Zoologici 55: 401–407.

Kurina O, Oliveira SS (2013) The first *Cordyla* Meigen species (Diptera, Mycetophilidae) from continental Australia and Tasmania. ZooKeys 342: 29–43. doi: 10.3897/zookeys.342.6045

Kurina O, Õunap E, Põldmaa K (2015) Two new *Neuratelia* Rondani (Diptera: Mycetophilidae) species from Western Palaearctic: a case of limited congruence between morphology and DNA sequence data. ZooKeys 496: 105–129. doi: 10.3897/zookeys.496.9315

Meigen JW (1803) Versuch einer neuen Gattungseintheilung der europäischen zweiflügeligen Insekten. Magazin für Insektenkunde 2: 259–281.

Meigen JW (1818) Systematische Beschreibung der bekannten europaischen zweiflugeligen Insekten 1. Aachen, 332 pp.

Morrone JJ (2014) Biogeographical regionalisation of the Neotropical region. Zootaxa 3782(1): 1–110. doi: 10.11646/zootaxa.3782.1.1

Oliveira SS, Silva PCA, Amorim DS (2007) Neotropical, Circum-Antarctic and Nearctic overlap? Mycetophilidae (Diptera) of Colombia and its biogeographic implications. Darwiniana 45: 106–107.

Oliveira SS, Amorim DS (2011) *Docosia adusta* sp. nov. (Diptera: Mycetophilidae) from the Colombian Andes: a Holarctic element in northwestern South America. The Canadian Entomologist 143: 688–696. doi: 10.4039/n11-033

Oliveira SS, Amorim DS (2012) Six new species of *Paraleia* Tonnoir (Diptera, Mycetophilidae): amphinotic elements at the northern range of the Andes. Zootaxa 3186: 1–24.

Rindal E, Søli GEE, Bachmann L (2009) On the systematics of the fungus gnat subfamily Mycetophilinae (Diptera): a combined morphological and molecular approach. Journal of Zoological Systematics and Evolutionary Research 47(3): 227–233. doi: 10.1111/j.1439-0469.2008.00498.x

Sasakawa M (2005) Fungus gnats, lauxaniid and agromyzid flies (Diptera) of the Imperial Palace, the Akasaka Imperial Gardens and the Tokiwamatsu Imperial Villa, Tokyo. Memoirs of the National Science Museum (Tokyo) 39: 273–312.

Sasakawa M (2008) Fungus gnats (Insecta, Diptera, Mycetophilidae) of the Imperial Palace, Tokyo. Bulletin of the National Science Museum Series A 34 (1): 21–39.

Søli GEE, Vockeroth JR, Matile L (2000) A.4. Families of Sciaroidea. In: Papp L, Darvas B (Eds) Contribution to a Manual of Palaearctic Diptera. Appendix. Science Herald, Budapest, 49–92.

Staeger C (1840) Systematisk Fortegnelse over de i Danmark hidtil fundne Diptera. Tipularia Fungicolae. Naturhistorisk Tidsskrift 3: 228–288.

Ševčík J, Kjærandsen J (2012) *Brachyradia*, a new genus of the tribe Exechiini (Diptera: Mycetophilidae) from the Oriental and Australasian regions. The Raffles Bulletin of Zoology 60(1): 117–127.

Tuomikoski R (1966) Generic Taxonomy of the Exechiini (Dipt., Mycetophilidae). Annales Entomologici Fennici 32: 159–194.

Vockeroth JR (2009) Mycetophilidae (Fungus gnats). Manual of Central American Diptera 1: 267–278.

Wu H, Zheng LY (2000) Study on *Cordyla* from China (Diptera: Mycetophilidae). Acta Zootaxonomica Sinica 25: 446–448.

Zaitzev AI (2003) Fungus gnats (Diptera, Sciaroidea) of the fauna of Russia and adjacent regions. Part II. An international Journal of Dipterological Research 14: 77–386.